REMARKS

Claims 1, 7, 14 and 23 have been amended to characterize the semiconductor switch as having a DC current detecting function with a terminal for current detection to detect a DC current which flows in the electrothermal heating element. Claim 1 further recites that the air heater system includes resistance value control means for controlling a resistance value of the electrothermal heating element based on output corresponding to the DC current which flows in the electrothermal heating element. Claims 3 and 22 have been amended to conform to the amendment to claim 1. One of ordinary skill in the art would clearly understand "DC current" from the explanation in the specification and Fig. 4 using a battery 220 (for example, the circuit of Fig. 4 includes a vehicle-mounted battery 220), which is a DC current source. See also the specification at page 35, line 7.

Entry of the amendments and review and reconsideration on the merits are requested.

Claim 23 was rejected under 35 U.S.C. § 112, first paragraph. In the Examiner's view, the negative limitation "without using a heater current detecting resistor placed in series with the semiconductor switch and the electrothermal heating element" does not find adequate support in the specification as originally filed. The Examiner reasoned that the description which relates to inserting additional resistance bridging pages 2-3 of the specification does not support the subject negative limitation.

Applicants respectfully disagree.

One skilled in the art in reading the subject passage would understand that the "additional resistance" refers to measuring the voltage drop across a resistor inserted in series with the heating element so as to measure the current flowing therethrough. This passage should also be read in conjunction with Fig. 4 where there is no resistor in series with the heating element 120.

Accordingly, it is respectfully submitted that the subject limitation of claim 23 finds §112, first paragraph support in the specification as originally filed, and withdrawal of the foregoing rejection is respectfully requested.

Claims 1, 3, 21, 22 and 23 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,464,965 to McGregor et al. McGregor et al. was cited as disclosing an air heater system for a vehicle (pitot tube heater for an aircraft) meeting each of the terms of the rejected claims.

Applicants responds as follows.

The air heater system of the invention is characterized as comprising a semiconductor switch having a DC current detecting function connected in series to an electrothermal heating element; an electronic control unit receiving the DC current signal so as to control on-off switching of the semiconductor switch; resistance value control means for controlling the resistance value of the electrothermal heating element based on DC current flowing through the series circuit detected by the semiconductor switch; and means for detecting a voltage signal across the electrothermal heating element, the ECU determining a resistance value based on the current and voltage signals.

Turning to the cited prior art, McGregor et al. relates to a heater for warming a pitot tube (a measuring device for measuring the speed of an airplane) found in airplanes, but not for use in cars or motor vehicles. In reference to the description at cols. 1-2 and Figs. 2 and 5 of McGregor et al., the resistance of the pitot probe (pitot tube) heater varies with temperature, and current samples are taken during a period of a half cycle of the AC voltage (115 VAC in Fig. 5 at 400 Hz). That is, the AC voltage is connected to terminal 17 and the heater is connected to terminal 11 to allow current to pass through 13, 16 and 19 in Fig. 2.

As illustrated in Fig. 5, a current sensor 15 detects current of the heater by use of a current transformer 47. A voltage sensor 19 is also used to detect voltage by means of the transformer.

Although a resistor *per se* is not provided to detect current, current detection is performed based on the impedance of the current transformer. In Fig. 5, specifically, current passes through a primary winding (coil) as a current sensor (current transformer). That is, McGregor et al.'s device includes an impedance inserted in the AC current path, which is equivalent to a resistance component inserted in a DC current path.

In light of basic common knowledge in electrical technology that impedance in an AC circuit corresponds to a resistor in a DC circuit, inserting a series impedance for current detection in McGregor et al.'s circuit is analogous to inserting a series resistor for current detection in a DC circuit. That is, McGregor et al.'s device is similar to the conventional technique discussed in the Background Art portion of the present specification which describes current detection using a resistor.

Current sensor 15 (current transformer 47) and voltage sensor 19 in McGregor et al.'s circuit can only be operated in an AC mode. McGregor et al. discloses methods directed to an AC circuit as seen from claim 1 (i.e., the applied voltage has a predetermined frequency).

Therefore, McGregor et al. fails to meet the limitations of claims 1 and 23 which require a semiconductor switch having a DC current detecting function provided with a terminal for current detection to detect a DC current which flows in the electrothermal heating element. Moreover, McGregor et al. fails to meet the resistance value control means of claim 1 for controlling a resistance value of the electrothermal heating element based on output corresponding to the DC current which flows in the electrode thermal heating element detected

through the current detection terminal of the semiconductor switch. For at least these reasons, it is respectfully submitted that claims 1, 3, 21, 22 and 23 are not anticipated by McGregor et al.

McGregor et al. also does not disclose on-off switching of the semiconductor switch (corresponding to current sensor 15) based in part on the current signal as required by present claim 1. Rather, transistor 47 (see Fig. 2 of McGregor et al.) is switched on-off based on the current signal so as to supply power to the heating element (column 3, lines 34-40).[1] Also, the current sensor 15 of McGregor et al. is not connected in series for controlling *energization* to the heat electrothermal heating element as required by present claim 1. That is, transistor 47 of McGregor et al. is not a semiconductor switch of present claims 1 and 23 because it does not have a current detection function. On the other hand, current sensor 15 of McGregor et al. is not a switch, and considering that it employs coupling transformers, it also is not a semiconductor switch (as required by both claim 1 and 23).

More particularly, in McGregor et al., the current transformer different from a semiconductor switch has a current detecting function.

The Examiner stated in the Office Action, for example, on page 5, line 2, that a signal of switch 13 is connected to the current sensor 15. However, as clearly seen in from Fig. 5 of McGregor et al., the switch 13 is merely operated to selectively allow or disallow current to be applied to the current transformer 47 constituting the current sensor 15. No signal is outputted from the switch 13, such that the switch 13 could not be combined with the current sensor 15 to incorporate the current sensor function.

[1] Reference No. 47 in Fig. 5 represents a current transformer, and reference No. 47 represents a transistor in Fig. 2.

For this additional reason, it is respectfully submitted that claims 1, 3, 21, 22 and 23 are not anticipated by McGregor et al., and withdrawal of the foregoing rejection under 35 U.S.C. § 102(b) is respectfully requested.

Claims 1 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Publication No. US 2002/0011484 to Beetz et al. in view of McGregor et al. The Examiner cited Beetz et al. as disclosing the air heater of claim 4 including a frame which holds the electrothermal heating element and a semiconductor switch fixed to the frame. Beetz et al. was also cited as disclosing the limitation of a semiconductor switch connected to the electrothermal heating element in series for controlling energization to the electrothermal heating element (control board 10 including control electronics 12 to determine the amount of current delivered by power transistors 11 to respective heating elements 2). McGregor et al. was cited as disclosing a semiconductor switch having a current detecting function and other limitations of claim 1 as discussed above.

Applicants respectfully traverse for the following reasons.

Power transistors 11 of Beetz et al. do not have a current detecting function, and Beetz et al. likewise fails to disclose a semiconductor switch of present claim 1 having a current detecting function.

Moreover, as shown above, McGregor et al.'s semiconductor switch (transistor 47) itself has no current detecting function (the current detecting function is carried out by current sensor 15), let alone a DC current detecting function as required by amended claim 1. Further, Beetz et al. does not make up for the deficiencies in McGregor et al. as pointed out with respect to the rejection of claims 1, 3, 21, 22 and 23 under 35 U.S.C. § 102(b).

Withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Claims 5 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Beetz et al. in view of McGregor et al., further in view of JP 07078671 to Hidetaka et al. as evidenced by U.S. Patent No. 5,057,672 to Bohlender et al. Hidetaka et al. was cited as disclosing a heat radiating part including a frame-shaped case made of a heat resistant resin, and Bohlender et al. was cited with respect to the temperature converging property.

Applicants rely on the response above with respect to the rejection of claim 1 over McGregor et al.. None of the cited prior art including McGregor et al. discloses a semiconductor switch having a DC current detecting function.

Withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Claims 7-11 and 14-18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Beetz et al. in view of McGregor et al., further in view of U.S. Patent No. 6,747,432 to Yoshimura. Yoshimura was cited as disclosing resin-molding to produce a dustproof and waterproof-sealed circuit.

Claims 12, 13, 19 and 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Beetz et al. in view of McGregor et al., and Yoshimura as applied to claims 7 and 14 above, further in view of U.S. Patent No. 6,747,432 to Yoshimura.

Applicants rely on the response above. None of the cited prior art, including McGregor et al., discloses the claimed semiconductor switch having a DC current detecting function as required by amended claims 7 and 14.

Applicants further comment as follows.

The Examiner considered that the features of claims 8 and 15 are disclosed by Beetz et al. in which a heater control device is fixed to a frame. Beetz et al., however, concerns cooling the power transistors 11 to prevent them from becoming too hot even when the heater temperature

rises and the heater draws more current through the power transistors 11. There is no disclosure in Beetz et al. to the effect that the power electronics component 11 (power transistor) has an excessive temperature rise protecting function. The power transistors 11 which are being cooled by cooling element 6 will not increase in temperature in correspondence with an increase in temperature of the heater element 2. Thus, Beetz et al. does not allow for detecting abnormality of the heater temperature based on the temperature of the power electronics component 11 (power transistor 11 which is cooled by heat sink 6) so as to shut off the current flowing in the heater and the component 11 itself.

On the other hand, the subject matter of claims 8 and 15 of the invention is directed to an increase in temperature of the semiconductor switch in accordance with the heater temperature. That is, Applicants respectfully dispute that Beetz et al. discloses the subject matter of claims 8 and 15.

Further, Beetz et al. does not disclose shutout of heater energization by use of an alarm function of the semiconductor switch which is the subject matter of claims 10 and 17.

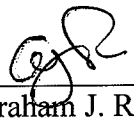
Withdrawal of the foregoing rejections under 35 U.S.C. § 103(a) is respectfully requested.

Withdrawal of all rejections and allowance of claims 1 and 3-23 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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